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(54) PROCESS FOR ABSORBING OIL

(71) We, CAPE INSULATION LIMITED, a Company organised under the laws of Great Britain, of 114 Park Street, London W.1., do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a new method of absorbing oil.

It is well known that the spillage or leakage of oil whether from oil tankers or ships bunkers at sea or in port or canals, presents a considerable problem since such oil constitutes a nuisance and moreover is difficult to disperse or dispose of. Several solutions to this problem have been tried. One utilizes large volumes of surfactants, which are sprayed over the oil and which have the effect of changing the water-in-oil emulsions into dispersible oil-in-water emulsions. Another utilizes oleophilic powders or granules with the object of absorbing oil, flocculating it and causing it to sink. And a third employs floating booms of, for example, polyurethane foam, the function of which is to surround and contain the oil, thereby restricting it to a small area from which it may be collected, treated or disposed of. All of these methods are expensive and have practical objections.

On a smaller scale there is the problem of the spillage or leakage of oil from automobiles standing in garages or from lorries on the highway, and this has been overcome to some extent by collecting the oil leaking from an automobile engine by means of a shallow drip tray which was one filled with soil or sawdust but now, to avoid spontaneous combustion, is more frequently filled with absorbent mineral granules.

It is the object of the present invention to provide a method of absorbing oil using a medium which is relatively cheap and effective, and from which the oil can be removed without great detriment to the medium by burning at sea, or by removing the medium from the sea to land and then burning the oil off.

According to the present invention a method of absorbing oil comprising contacting the oil with a mass of inorganic fibres wherein the fibres are coated with a water repellent agent.

We have found that inorganic fibres, for example glass fibres, slag wool fibres and mineral wool fibres such as rock-wool fibres, are effective absorbents of oil when in bulk, e.g. mat form. We have further found that the degree of oil absorption of a mass of such fibres is a function of the density of the mass; the less dense the mass the greater its absorbing power, and vice versa. For example, a mat of rock-wool fibres having a density of 1 to 2 lb. per cubic foot will absorb 12 to 15 times its weight of oil, and may be used, for example, for absorbing oil from patches of oil spilled at sea or for mopping up oil which has spread over beaches or on to the land. A bale of rock-wool fibres having a density of between 4 and 6 lb. per cubic foot will absorb 5 to 8 times its weight of oil, and may also be used in connection with oil spilled accidentally at sea or for the protection of harbours, ports, coves, estuaries, rivers and canals.

Generally speaking, we prefer that the mass of inorganic fibres used according to the invention should have a density in the range 1 to 10 lbs. per cubic foot.

The coating of the fibres, to be used in accordance with the invention, either during their production or subsequently, with a water repellent agent greatly enhances the efficiency of absorption of oil relative to water by the fibres.

Preferably, sufficient of such agent is coated onto the fibres that the coated fibres

[Price 25p]

comprise 0.5 to 2% by weight of the water repellent agent. In one embodiment of the invention an emulsion of crude or refined petroleum oil of suitable viscosity is uniformly spread on to the inorganic fibres so that they have a coating of 1 to 2 per cent of oil which imparts water repellency. A more effective type of agent is a silicone in solution or emulsion form, the silicone being of the kind designed to impart a high degree of water repellency. Alternatively the fibres may be treated during their production or subsequently with long-chain cyclic amines or their salts. These have the effect of attracting oil and repelled water even when very small proportions are used as a coating to the fibres.

Inorganic fibres such as rockwool fibres made up into the forms described above and treated with such water repellent agents float on water and in the presence of oil on the surface of the water the mass of fibres absorbs the oil until all the interstices between the fibres are filled with oil. The oil is thereby substantially removed from the surface of the water. The mass of fibres will continue to float and in this condition the oil can be ignited, the inorganic fibres acting as a wick and allowing further oil to be absorbed until such time as substantially all the oil in the vicinity of the fibres has been removed. This is a most important advantage, since the fibre mass is not itself consumed by the burning and furthermore still retains its absorbing properties after the oil has been burnt off because the carbonaceous residue is itself water repellent. It is thus possible to use the same mass of fibres repeatedly. The absorbing of the oil will also be effected even if it is mildly emulsified by wave action on the surface of the water.

The inorganic fibres forming the mass, whether it be in mat, pad or block form, may be bonded together into a rigid or semi-rigid self-sustaining from, and suitable adhesives for this purpose include phenol-formaldehyde and urea-formaldehyde resins. The fibres may be bound together into pad or block form using thin wire. If desired the fibrous mass may be attached, e.g. bonded, to a sheet of facing or backing material, for example for decorative or other purposes. A "drip-tray" for use in garages may, for example, be made by laminating a mat of mineral wool fibres to a backing sheet of a liquid impermeable material such as polyvinyl chloride sheet.

The following is a list of applications in which the oil absorbing properties of olephilic inorganic fibres may be manifested.

(1) When a large amount of oil is spilled into the sea it quickly spreads, loses volatiles, and gradually emulsifies. To eliminate the nuisance by burning, a large number of oleophilic inorganic fibre mats may be dropped onto the surface of the oil and after the oil has reached the top of the mats combustion can be initiated. Combustion is not readily sustained on the open sea but is is promoted by the wick effect of the fibres. Hence it is advisable to have a large number of such burning points over the affected area. Absorbent mats may be easily, cleanly and safely stored at aerodromes in readiness for use for they do not deteriorate on storage or present any fire risk.

(2) Booms made by joining together bales of oleophilic inorganic fibres may be taken by sea with the object of containing the oil and removing it by burning at the edges of the oil slick. The booms may be made by filling perforated containers with bales of water repellent inorganic fibres, with mats of the same material or with loose inorganic fibres, and then arranging the containers into the required form and with strong enough links to allow the boom to be towed and brought into place. In practice the booms would be used to surround an oil slick and the oil would migrate to and be absorbed by the inorganic fibres. Thereafter the oil may be burned off on site or the booms or boxes with their loads of oil may be towed away for disposal at convenience and replaced by a boom containing fresh absorbing material. Units for the rapid construction of booms can be stored at strategic points along the coast from which they can be transported to the site of pollution.

(3) Similar booms can be made up in readiness for the protection of harbours, ports, estuaries, canal entrances, oyster beds and places of scenic beauty, and placed in positon as soon as an oil pollution danger has been announced.

(4) Pollution of enclosed waters such as rivers and canals by oil has been a most intractable problem. Booms of oelophilic inorganic fibres would be slowly drawn through the surface layers of the water; not only would the oil be absorbed but the flotsam would be skimmed off at the same time.

(5) The mopping up of oil spillage on land, for example caused by accidents to road tankers carrying oil, oil spilled on motor race tracks and aerodromes and oil thrown up on beaches or port installations may be dealt with by placing absorbent mats over the contaminated area. The mats, of approximate thickness $\frac{1}{2}$ inch to 3 inches and of any convenient area, may be allowed to absorb their full amount of oil and then be removed for burning or disposal. It is to be understood that in such situations it may be

advantageous to add solvent to thin the oil so that the spillage may be more readily absorbed by the mat.

(6) The collecting of oil leaking from the sumps of automobiles, especially in private and commercial garages and showrooms, may be accomplished by a loose mass of oleophilic fibres or preferably be a bonded mass, i.e. the fibres being held together by means of a binder. Examples of suitable binders include resins such as phenol-formaldehyde and urea-formaldehyde resins. The bonded pad of fibres may be provided with an impermeable base such as a sheet of p.v.c.

(7) A similar method of collection may be used in factories where oil drips occur. Since the absorbent is usually placed in a drip-tray it can be in the form of a pad of absorbent, bonded fibres normally without an impermeable backing.

Among the other advantages of the absorbing media of the invention are that they are non-toxic, and so do not destroy living organisms in the sea or pollute the sea bed and being light in weight can be stored in buildings of low load-bearing construction, e.g., in the attics or upper storeys which could not be used for storing drums of surfactants or bags of mineral flocculent granules.

The following Examples are given for the purpose of illustrating the invention.

Example 1.

A fibrous pad measuring approximately 3″ × 3″ × 2″ was prepared by lightly binding "Rocksil" rock wool fibres together with very thin wire. The fibres had a mean diameter of 6.3 microns and were coated with an emulsion of mineral oil and water during manufacture. The total oil content of the pad was 1.3% by weight and it had a bulk density of 4.0 lb./ft^3. When it was placed in a pool of crude oil floating on water it immediately absorbed the oil. At saturation point the test sample was found to have absorbed 13 times its own weight of the oil. (The mineral oil emulsion used to coat the fibres was an emulsion of 2% of processed mineral oil in water, being that sold by Shell-Mex and B.P. Limited under the trade name "Nigrex". The emulsion was obtained using 5% of a sodium salt and vigorous stirring).

Example 2.

A fibrous pad measuring approximately 3″ × 3″ × 2″ was prepared by lightly binding glass fibres together with very thin wire. The fibres had a mean diameter of 5.1 microns and were coated with an emulsion of a silicone resin and water by impregnation and drying. The total resin content of the pad was 0.7% by weight and it had a bulk density of 4.4 lb/ft^3. When it was placed in a pool of crude fuel oil floating on water, it immediately absorbed the oil. At saturation point the test sample was found to have absorbed 11 times its own weight of the oil. (The silicone resin emulsion used was that sold by I.C.I. Limited under the trade designation EP 5766. This is an aqueous emulsion of methyl polysiloxanes).

Example 3

A fibrous pad measuring approximately 3″ × 3″ × 2″ was prepared by lightly binding "Rocksil" rock wool fibres together with very thin wire. The fibres had a mean diameter of 6.3 microns and were coated with a solution of a long chain cyclic amine by impregnation and drying. The total cyclic amine content of the pad was 1.0% by weight and it had a bulk density of 3.9 lb./ft.^{3} When it was placed in a pool of crude fuel oil floating on water, it immediately absorbed the oil. At saturation point the test sample was found to have absorbed 12 times its own weight of the oil. (The long chain cyclic amine used was that sold by Glovers Chemicals Limited under the trade name Bitran R).

Example 4.

A fibrous mat of approximately 1″ thickness and a bulk density of 4.1 lb./ft^3 was prepared from "Rocksil" rock wool fibres. The fibres had a mean diameter of 6.0 microns and were bonded with 1.6% by weight of phenolformaldehyde resin which was added during manufacture of the mat. The mat was impregnated with a solution of a quaternary ammonium salt in water and dried to give a product containing 1.0% by weight of the quaternary compound. Two pieces, each 3″ square, were cut from the mat and lightly bound together with very thin wire to give a fibrous pad measuring 3″ × 3″ × 2″. When it was placed in a pool of crude fuel oil floating on water, the pad immediately absorbed the oil. At saturation point the test sample was found to have absorbed 12.5 times its own weight of the oil. (The quaternary ammonium salt used was that sold by Glovers Chemicals Limited under the trade name Bitran CW).

WHAT WE CLAIM IS:—

1. A method of absorbing oil comprising contacting the oil with a mass of inorganic fibres wherein the fibres are coated with a water repellent agent.

2. A method according to claim 1 wherein oil is removed from the surface of water or from an emulsion of oil and water by contacting the oil with a mass of inorganic fibres as described in claim 1 wherein the inorganic fibres are capable of floating on the surface of the water.

3. A method as claimed in claim 1 or 2, wherein the fibres are glass fibres, slag wool fibres or mineral wool fibres.

4. A method as claimed in any of claims 1, to 3, wherein the fibres are rock-wool fibres.

5. A method as claimed in any of claims 1 to 4, wherein the density of the mass is in the range 1 to 10 lbs/cubic foot.

6. A method as claimed in any of claims 1 to 5, wherein the coated fibres comprises 0.5 to 2%, by weight of the water repellent agent.

7. A method as claimed in any of claims 1 to 6, wherein the water repellent agent is a mineral oil, a silicone resin, a long chain cyclic amine or a salt thereof.

8. A method as claimed in any of claims 1 to 7, wherein the fibres are bonded together.

9. A method as claimed in claim 8, wherein the fibres are bonded together by means of a phenol-formaldehyde or urea-formaldehyde resin.

10. A method as claimed in any of claims 1 to 9, wherein the mass of inorganic fibres is in the form of a mat or pad.

11. A method as claimed in claim 10, wherein there is attached to one face of the mat or pad a liquid impermeable backing.

12. A method as claimed in any of claims 1 to 9, wherein the fibres are in the form of a block or bale.

13. A method as claimed in any of claims 1 to 12, wherein the mass of inorganic fibres is contained in a perforated container.

14. A method according to claim 2 or any of claims 3 to 13 as dependent on claim 2, wherein the absorbed oil is ignited so that the inorganic fibres are able to act as a wick and thereby absorb further oil until substantially all the oil in the vicinity of the fibre has been removed.

15. A method of absorbing oil, substantially as hereinbefore described in any of the Examples.

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